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ABSTRACT

The purpose of this study was to test the hypothesis that there are positive correlations among: (1) attitudes toward science, (2) self-concept, and (3) achievement of science process skills. The 68 students who served as subjects were juniors and seniors enrolled in science methods courses in elementary education. The Moore and Sutman (1970) Scientific Attitude Inventory (SAI) was used to gather data on student attitudes. Posttest items were constructed based on the Basic Science Process Skills (BSPS) and the Integrated Science Process Skills (ISPS). Fitts' (1964) Tennessee Self-Concept Scale (TSCS) was used to gather data on self-concept. Data were analyzed using Pearson's product-moment correlation coefficients. There were positive correlations between: (1) basic science process skills and integrated science process skills, (2) basic science process skills and attitudes toward science, (3) basic science process skills and self-concept, (4) integrated science process skills and attitudes toward science, (5) integrated process skills and self-concept, and (6) attitudes toward science and self-concept. (Author/MH)

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A STUDY OF RELATIONSHIPS OF SCIENCE ATTITUDES, ACHIEVEMENT AND SELF-CONCEPT OF PRE-SERVICE TEACHERS*

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Introduction

A recent survey conducted by the National Assessment of Educational Progress Committee (1975) showed that science knowledge at all levels of education is declining. These results should be alarming to all educators, since our society is becoming more technological and complex. Many decisions concerning population growth, ecology, pollution and politics requiring scientific knowledge will have to be made by the very students who are now receiving inadequate instruction in science. How can future citizens make sound decisions about our environment if they themselves lack adequate information to do so? The answer is obvious, they cannot.

The basic question is then: How can science knowledge be improved? A possible answer to this question might be with the person who is providing the instruction, mainly the teacher. According to Blackwood (1964) in a nationwide survey

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of elementary teachers and principals, it was revealed that one of the barriers to effective science teaching was the lack of teachers' interest in science. This decline in science knowledge is further explained by Stollberg (1969) when he stated that teachers who have negative or neutral attitudes toward science usually pass these on to their students. Stollberg's statement is supported by Hone and Carswell (1969) when they write: "Children's built-in radar is fine tuned to their teacher's feelings about science." Furthermore, in a study by Washton (1971) it was reported that pupils imitate the attitudes of their teachers toward science. These results are self-explanatory; teachers who have negative attitudes toward science will not teach it in a positive manner to their students.

A number of studies by Campbell (1973), Campbell and Schaffer (1975), Jaus (1975) and Kennedy (1971) examined the effects of science process skills instruction on teacher attitudes. Only the study by Kennedy reported a change in teacher attitudes.

Another variable that might be used to explain teacher's apprehension toward science is self-concept. There is some evidence by Walsh (1956) and Wattenburg and Clifford (1964) that when intellectual ability is controlled, self-concept is a basic casual factor in determining achievement level in

school. While these studies involve elementary school children, the idea of studying self-concept has merit and should be examined in terms of teacher attitudes and achievement.

Purpose

One purpose of this study was to assess the correlation of three variables: 1) achievement, 2) attitudes toward science and 3) self-concept of pre-service elementary teachers. Another purpose was to determine if the independent variables, attitudes toward science and self-concept can be used as predictors of achievement.

Method

Subjects

The sixty-four (64) students who served as Ss for this study were juniors and seniors enrolled in science methods courses in elementary education at Florida International University during the Spring quarter of the 1974-75 school year.

Instruments and Procedures

Instruction was based on a modular package developed by Campbell (1974). The package consisted of four modules that were designed to help teachers implement science process

skills and to develop positive attitudes toward science. Topics included in the module package consisted of the following:

a. Two self instructional programs. One on basic science process skills (Okey and Campbell, 1973) and the other on integrated process skills (Okey and Fiel, 1972),

b. laboratory investigations related to elementary science curriculum projects materials,

c. a series of 15 minutes micro-teach lessons on science topics,

d. lesson plans based on community resources,

e. elementary science projects, and

f. enrichment activities including supplementary readings in science books.

Each module contains an introduction, goal, task(s), enablers and instructional resources. The self-instructional programs aforementioned consisted of objectives, practice exercises, feedback on exercises, self-tests and self-test answers. Examples of process skills involved in the program are: measurement, classification, constructing graphs and operationally defining variables.

All Ss met at regular time periods for methods instruction (four hours a week) and were given Wednesday of each week to carry out tasks with children in field center schools. All classes were taught by the same teacher. Although students were provided with a work completion time schedule, they

were given the opportunity to hand in work as they completed the tasks throughout the quarter.

Measures

Attitudes Toward Science

The Scientific Attitude Inventory (Moore and Sutman, 1970) which measures attitudes toward science, was administered and scored by the investigators.

Science Process Skills Tests

The process skills achievement tests* Basic Science Process Skills (BSPS) and Integrated Science Process Skills (ISPS) were developed to measure achievement of the objectives listed in the science process skills instructional programs. The BSPS consisted of 16 items worth 32 points and the ISPS consisted of 6 items worth 20 points. Reliability coefficients for these tests was found to be .92 (BSPS) and .96 (ISPS) using the Hoyt reliability formula.

Self-Concept

The Tennessee Self-Concept Scale (TSCS--Fitts, 1965) was administered to determine the relationship between self-concept of students and their achievement and their attitudes toward science.

Results and Discussion

Table I below lists the Pearson product-moment correlation coefficients describing the degree of relation between var-

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*These tests were developed by the first author

iables. The variables under consideration are: achievement of science process skills, attitudes toward science and self-concept. Table I lists BSPS and ISPS as measures of achievement of science process skills, SAI as the measure of attitudes toward science and TSCS as the measure of self-concept. Significant positive correlations were found between teachers' achievement test scores, and their attitudes toward science and their self-concept scores.

TABLE I

Correlation Coefficients Among Achievement of Science Process Skills, and Attitudes Toward Science and Self-Concept

(N=64)

	BSPS	ISPS	SAI	TSCS
BSPS	----	0.71*	0.54*	0.61*
ISPS		----	0.55*	0.60*
SAI			----	0.76*
TSCS				----

$p < 0.001$

Once it was determined that there were significant correlations between the variables, correlation regression coefficients were calculated to determine which variables, if any, could be used as predictors of achievement. Table II

contains the multiple regression coefficients for the dependable variable BSPS achievement test scores and two independent variables: attitudes toward science and self-concept.

TABLE II

Correlation Regression Coefficients for BSPS and Two Independent Variables

Variable	Type	Regression Coefficient	Std. Regression Coefficient	Sig. Level
BSPS	Dep.	-----	-----	-----
Attitudes	Ind.	.1961	.1676	.2037
Self-Concept	Ind.	.1986	.3207	.0168*

$p < 0.05$

From the data presented in Table II it can be seen that only one variable, self-concept, was found to be a predictor of BSPS achievement. Table III below contains data on the dependent variable ISPS and the two independent variables. Self-concept was again found to be a predictor of ISPS achievement.

TABLE III

Correlation Regression Coefficients for ISPS and Two Independent Variables

Variable	Type	Regression Coefficient	Std. Regression Coefficient	Sig. Level
ISPS	Dep.	-----	-----	-----
Attitudes	Ind.	.2323	.1951	.1451
Self-Concept	Ind.	.1695	.2688	.0463*

$p < 0.05$

Conclusions and Implications

Based on the results of this study, it was determined that the self-concept of elementary pre-service teachers is significantly related to their achievement of science process skills and their attitudes toward science. This finding is in support of the results reported by Alvord and Glass (1974); Lamy (1965) and Wattenburg; and Clifford (1962). Although all these studies involved elementary school children, they do provide the theoretical basis for examining the self-concept of pre-service teachers in terms of attitudes toward science and achievement of science process skills. If it can be observed that the self-concept of elementary school children is related to their performance in school, it is reasonable to believe that the performance of pre-service

teachers might likewise be affected.

Furthermore, it was determined that self-concept is a variable that can be used to predict achievement of science process skills. The implications of this finding are important to science educators in the planning of instruction and to prospective employers in the selection of elementary teachers. However, before the latter is recommended for implementation, further research is needed to determine if an increase in one of the variables causes an increase in any of the others.

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